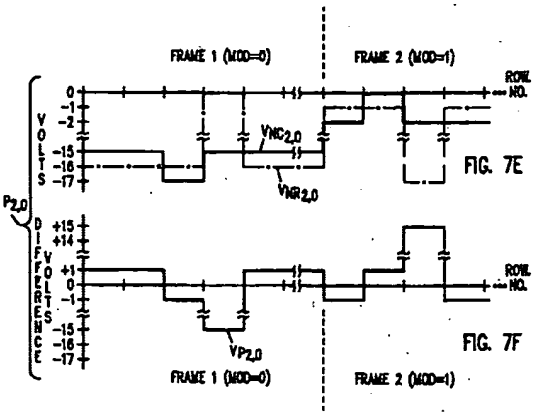
COMPENSATION PIXEL

SCANTIME DURATION _____ 1
512 2 256 3 128
4 64 5 32 6 16 7 8 8 4 _____

Detailed Description Paragraph Table - DETL (16):
TABLE 17 _____ CLEAR previous for COLUMN
= 0 to 40 step 16 'Assume we read 16-pixels/read on a '640 column LCD; CLEAR
PACC 'Start new column with "0"; CLEAR TACC Start a new column with "0"; for
LINE = 0 to 239 'Assume a 480-line dual-scan LCD; temp = READ (LINE,COLUMN)
'get 16-pixels from the grayscaled 'full-frame memory; for x = 0 to 15
'process the 16-pixels obtained with 'the 1-read; pix(x) = bit(temp,x)
'separate the 16-bits into individual 'pixels; 'the value is either 1 'or 0 (on or off 'pixel); PACC(x) = PACC(x) + pix(x) 'Running total of # pixels ON

in 'a column; trans = previous(x) (xor) pix(x) 'if the previous lines pixel was the 'same, then transition = 0, else '1; TACC(X) = TACC(X) + trans 'Running total of # transitions in 'a column; previous(x) = pix(x) 'this line is now "history", it will be 'used next time; next x ' next LINE ' 'at this point, the 16-byte internal 'registers (PACC(x) and TACC(x)) 'contain the final value for the entire 'column of 16-pixels; 'the amount of compensation is determined next: for x = 0 to 15 comp(x) = k1 * [PACC(x) * (1
- k2 * x/639) + k3 * TACC(x))] address = COMPADDR * 640 + COLUMN*16 + x data
= comp(x) ' WRITE (address,data) 'store it in VMEM; next x ' next COLUMN
'Do all 40 16-pixel columns; _____



display device and its driving method

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Detailed Description Text - DETX (3):

FIG. is a plan view of a liquid crystal display device of the present invention and is comprised by a liquid crystal panel 1 and driving circuits 10-12. In the liquid crystal panel a ferroelectric liquid crystal is sandwiched between an upper substrate 2 having signal electrodes 4 and a lower substrate 3 having scanning electrodes 5. Pixel pitch is 90 .mu.m while gap between pixels is 5 .mu.m. FIG. 2 shows a section views of liquid crystal panel 1, in which each pattern of stripe-shaped transparent electrodes 4 and 5 is formed on a glass and an alignment layer 6 is formed on each electrode pattern. The liquid crystal may be an ester ferroelectric liquid crystal. The thickness of liquid crystal layer 7 is 2.0 .mu.m. Alignment layer 6 is formed by depositing SiO in a direction inclined by 82.degree. from the substrate normal line. The bright and shade pattern is displayed with a birefringence effect by pasting polarizers 9a and 9b in a right angle to each other on the upper and lower substrates. A driving circuit part is composed of a scanning electrode driving circuit (SCAN-DC) 10, a signal electrode driving circuit 11 (SIG-DC), and a base signal generating circuit 12 (BSGC). With these circuits, the driving waveform as shown in FIG. 3 is applied to each pixel of liquid crystal panel 1. The display state after the driving waveform is applied to each pixel is shown in FIG. 1 such that a dark area in liquid crystal panel is illustrated with hatching lines while a bright area is illustrated with blank white. The pixels inside 8a encircled by a solid line are applied with an ON signal while the pixels inside 8b encircled by a broken line are applied with an OFF signal. FIG. 3 (a) shows a voltage to be applied to an ON pixel connected to a certain scanning electrode, and FIG. 3 (b) a voltage to an OFF pixel connected to the following scanning electrode. Scanning by a voltage selection scheme is carried out after making the whole panel dark condition at reset phase 20. When a bipolar pulse having Vr= 25 volt and Tr=1 millisecond at the part of reset phase 20 in FIG. 3 is applied over the whole panel, the liquid crystal in the panel being at a twist condition at the initial molecular orientation become a stable uniform stste with a jet black including a gap area between the pixels. When the pulse of reset phase Vr=25 volt, Tr=less than 1 millisecond and more than 500 microsecond was applied only the gap between

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[54] **PIXEL-GAP CONTROLLED FERROELECTRIC LIQUID CRYSTAL DISPLAY DEVICE AND ITS DRIVING METHOD**

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[52] U.S. Cl. 359/86; 359/75; 359/85; 359/100; 340/784
[58] Field of Search ..... 350/332, 333, 350 S, 350/341, 339 R; 340/784, 805

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[57] **ABSTRACT**

A liquid crystal display device and its driving method of the present invention have a voltage application scheme to control a stable condition of a gap between pixels, by applying a voltage to a liquid crystal panel in which ferroelectric liquid crystal is sandwiched between substrates each having a plurality of electrodes. It is possible to implement the black matrix conditions with a simple configuration without a light shielding layer by controlling the stable condition of the gap, to display a grey tone with a combination of pixels and a gap, or to raise the opening ratio by making the condition between adjacent pixels and a gap the same condition.

12 Claims, 10 Drawing Sheets